

**REPORT TO THE CALIFORNIA LEGISLATURE**

**THE CALIFORNIA OIL TRANSFER AND TRANSPORTATION  
EMISSION AND RISK REDUCTION PROGRAM  
2004**

**Prepared by the California State Lands Commission  
April 2005**

## TABLE OF CONTENTS

|   |           |
|---|-----------|
| <b>EXECUTIVE SUMMARY .....</b>  | <b>ii</b> |
| <b>ABBREVIATIONS .....</b>  | <b>iv</b> |
| <b>PURPOSE OF THE PROGRAM.....</b>  | <b>1</b>  |
| <b>INFORMATION REQUIREMENTS .....</b>   | <b>1</b>  |
| <b>DEVELOPMENT OF THE OTTER FORM AND CONSULTATION WITH INDUSTRY... </b>   | <b>2</b>  |
| <b>ESTIMATION OF AIR EMISSIONS .....</b>  | <b>3</b>  |
| <b>VOYAGE ROUTES.....</b>   | <b>4</b>  |
| <b>CONFIDENTIALITY .....</b>  | <b>4</b>  |
| <b>OUTREACH TO THE INDUSTRY .....</b>   | <b>4</b>  |
| <b>DIFFICULTIES ENCOUNTERED IN IMPLEMENTING THE OTTER PROGRAM .....</b>   | <b>5</b>  |
| <b>THE OTTER DATABASE .....</b>   | <b>7</b>  |
| <b>REPORT TO THE LEGISLATURE .....</b>  | <b>7</b>  |
| <b>OIL TRANSFER AND TRANSPORTATION EMISSION AND RISK REDUCTION ACT<br/>STATISTICS FOR 2004.....</b>                         | <b>7</b>  |
| ANNUAL SUMMARY 2004 VOYAGES .....   | 7         |
| ANNUAL STATISTICS TABLE .....   | 8         |
| TANK VESSELS.....   | 9         |
| OCEAN AND COASTAL VOYAGES .....   | 9         |
| VOLUME OF OIL TRANSFERRED .....   | 10        |
| TYPE OF OIL TRANSFERRED .....   | 10        |
| <b>AIR EMISSIONS .....</b>  | <b>11</b> |
| NITROGEN OXIDE EMISSIONS (NO <sub>x</sub> ) .....   | 11        |
| HYDROCARBON EMISSIONS (HC) .....  | 11        |
| PARTICULATE MATTER EMISSIONS (PM) .....   | 12        |
| CARBON MONOXIDE EMISSIONS (CO) .....  | 12        |
| DISTRIBUTION OF EMISSIONS .....   | 13        |
| <b>CONCLUSION .....</b>   | <b>14</b> |
| <b>APPENDIX I: THE OIL TRANSFER AND TRANSPORTATION EMISSION AND RISK<br/>REDUCTION ACT OF 2002.....</b>                     |           |
| <b>APPENDIX II: THE OIL TRANSFER AND TRANSPORTATION EMISSION AND RISK<br/>REDUCTION FORM .....</b>                          |           |
| <b>APPENDIX III: EPA TECHNICAL HIGHLIGHTS; EMISSION STANDARDS FOR<br/>MARINE DIESEL ENGINES: SCOPE OF APPLICATION .....</b> |           |
| <b>APPENDIX IV: THE VESSEL EMISSION ESTIMATION FORM .....</b>   |           |

## EXECUTIVE SUMMARY

The Oil Transfer and Transportation Emission and Risk Reduction Act of 2002, Public Resources Code Sections 8780 through 8789, (Act) established the California Oil Transfer and Transportation Emission and Risk Reduction (OTTER) program under the direction of the California State Lands Commission (CSLC). The Act requires the CSLC to file a report with the Legislature summarizing the information collected under the program.

The OTTER program collects data related to the intra-state or internal shipment of oil by marine vessels between facilities in the San Francisco Bay area and the Los Angeles/Long Beach area. The Legislature found that current, accessible and accurate data regarding oil transportation is critical to having adequate information of the potential environmental quality, public health, and environmental justice consequences that must be analyzed by state and local agencies for environmental impact reports and statements, emergency response planning, permit issuance, and air quality mitigation efforts. It also declared that tracking trends in internal shipment of oil is necessary to promote public safety, health, and welfare, and to protect public and private property, wildlife, marine fisheries, and other ocean resources, and the natural environment in order to protect and to preserve the ecological balance of California's coastal zone, coastal waters, and coastal economy.

To gather the necessary data as defined in the Act the CSLC was directed to develop the "Oil Transfer and Transportation Emission and Risk Reduction Form" to be completed by the owner of the oil involved in the internal shipment of oil. The form was developed and has been used by the responsible parties.

The CSLC is required to aggregate the OTTER information and provide it to the legislature in the form of annual reports for the years 2004 through 2009. The report is to discuss trends, provide specific information on air emissions and vessel types used as well as the number of transfers related to the shutdown of refineries.

The information collected by the OTTER Program did not previously exist. Now, planning organizations, State and Federal Agencies and organizations developing information for environmental documentation, will have a much more complete picture of the movement of oil along the California coast. The information in this first report stands alone. But, continued collection of OTTER information will allow future reports to look at trends and changes in oil transportation, and estimates of vessel air emissions along our central coast. It will allow planners to more precisely examine the impacts of moving oil by marine vessels.

Statistics for Calendar Year 2004 are provided on the following page. It is interesting to note that the number of vessel movements and the amount of cargo moved was far in excess of what was predicted during legislative development of the Act and follow-on meetings with the industry.

OTTER report forms for the year 2004 indicate:

|  |     |
|--|-----|
| Total number of internal voyages:  | 365 |
| Number of voyages from San Francisco Bay Area to Los Angeles/Long Beach: | 241 |
| Number of voyages from Los Angeles/Long Beach to San Francisco Bay Area: | 101 |
| Number of voyages from Ellwood to Long Beach:                            | 16  |
| Number of voyages from Ellwood to San Francisco Bay Area:                | 3   |
| Number of voyages from El Segundo Marine Terminal to Long Beach:         | 4   |

|  |                    |
|--|--------------------|
| Total quantity of crude oil shipped as internal shipments:   | 971,049 barrels    |
| Total quantity of refined oil shipped as internal shipments: | 31,678,507 barrels |

Total air emissions resulting from internal shipments of oil:

|                           |                      |
|---------------------------|----------------------|
| NO <sub>x</sub> emission: | 1,184.845 short tons |
| HC emissions:             | 54.523 short tons    |
| PM emissions:             | 80.801 short tons    |
| CO emissions:             | 159.259 short tons   |

During the year 2004, there were no internal shipments of oil due to refinery breakdowns.

## **ABBREVIATIONS**

|                 |   |
|-----------------|---|
| CO              | Carbon monoxide   |
| g/kw-hr         | Grams per Kilowatt Hour                                     |
| HC              | Hydrocarbon   |
| NO <sub>x</sub> | Nitrogen oxides   |
| OTTER           | Oil Transfer and Transportation Emission and Risk Reduction |
| PM              | Particulate matter  |
| PRC             | Public Resources Code                                       |
| TAG             | Technical Advisory Group                                    |
| USEPA           | United States Environmental Protection Agency               |
| WSPA            | The Western States Petroleum Association                    |

## **PURPOSE OF THE PROGRAM**

The Oil Transfer and Transportation Emission and Risk Reduction Act of 2002, Public Resources Code Sections 8780 through 8789, (Act) established the California Oil Transfer and Transportation Emission and Risk Reduction (OTTER) program under the direction of the California State Lands Commission (CSLC). The Act requires the CSLC to develop a program to implement the requirements of the Act.

The purpose of the OTTER program is to collect data related to the intra-state or internal shipments of oil by marine vessels between the San Francisco Bay area and the Los Angeles/Long Beach area. The Legislature found that current, accessible and accurate data regarding oil transportation is critical to having adequate information of the potential environmental quality, public health, and environmental justice consequences that must be analyzed by state and local agencies for environmental impact reports and statements, emergency response planning, permit issuance, and air quality mitigation efforts. It also declared that tracking trends in internal shipments of oil is necessary to promote public safety, health, and welfare, and to protect public and private property, wildlife, marine fisheries, and other ocean resources, and the natural environment in order to protect and to preserve the ecological balance of California's coastal zone, coastal waters, and coastal economy.

To gather the required data as defined in the Act the CSLC was directed to develop the "Oil Transfer and Transportation Emission and Risk Reduction Form" to be completed by the owner of the oil or a designated responsible party engaged in the internal shipment of oil. The form was developed and has been used by the oil owners and responsible parties. The CSLC is required to aggregate the OTTER information and provide it to the legislature in the form of annual reports for the years 2004 through 2009.

## **INFORMATION REQUIREMENTS**

The Act required the CSLC, in consultation with the industry, to develop an Oil Transfer and Transportation Emission and Risk Reduction Form for owners of oil or designated responsible parties to report information regarding the quantities and types of oil, the routes and duration of voyages and the estimated quantities of air emissions associated with the internal shipments of oil.

Specifically, the Act requires that the form contain the following:

- (1) The name, address, point of contact, and telephone number of the responsible party.
- (2) The name of the vessel transporting the oil.
- (3) The type and amount of oil being transported.
- (4) The source of crude oil.

- (5) The name and location of any terminal that loaded the vessel.
- (6) The name and location of any terminal that discharged the tanker or barge.
- (7) The dates of travel and the route.
- (8) The type of engine and fuel used to power the tanker or barge-towing vessel.
- (9) The estimated amount and type of air emissions. To the extent practicable, the emissions factors developed by the United States Environmental Protection Agency shall be used to estimate the amount of air emissions. The form shall be designed to ensure that charter vessel air emissions are not counted more than once.
- (10) An indication of whether the reason for the internal shipping of oil was due to a temporary shutdown or partial shutdown of a key refinery facility.
- (11) On and after January 1, 2004, if Division 36 (commencing with Section 71200) is repealed pursuant to Section 71271, the amount of any ballast discharge and the location of the discharge. This requirement was not invoked as The Marine Invasive Species Act of 2003 reauthorized and enhanced the state's program to prevent the introduction of nonindigenous aquatic nuisance species through vessel's ballast water discharges.

## **DEVELOPMENT OF THE OTTER FORM AND CONSULTATION WITH INDUSTRY**

The Public Resources Code (PRC) Section 8783 of requires the CSLC to consult with interested parties including operators, responsible parties and the International Maritime Organization (IMO) in developing the OTTER form and the reporting process. PRC Section 8785 requires the Commission to consult with the administrator, other state and federal agencies, the United States Coast Guard (USCG) and the federal Department of Transportation (DOT) to the maximum extent feasible before undertaking actions required by the statute.

In developing the form, CSLC staff first developed a draft OTTER Form containing the information requirements of the Act. Subsequently, Commission staff invited the Western States Petroleum Association (WSPA) and other industry representatives to participate in the finalization of the OTTER form as a Technical Advisory Group (TAG). WSPA is a non-profit trade association that represents approximately 30 companies that account for the bulk of petroleum exploration, production, refining, transportation and marketing in the six western states of Arizona, California, Hawaii, Nevada, Oregon and Washington. Founded in 1907, WSPA is the oldest petroleum trade association in the United States.

The CSLC staff discussed the OTTER program with staff from the Department of Fish and Game's Office of Spill Prevention and Response (OSPR), the Local U.S. Coast

Guard Captains of the Port and the District Marine Safety Division staff and requested these agencies to participate in the development of the OTTER form. At that time the Coast Guard was part of the U.S. Department of Transportation. The Federal Maritime Administration was also contacted. All parties declined to actively participate.

CSLC staff did not directly consult with the International Maritime Organization (IMO) as dealings with that organization are conducted exclusively by the U. S. Coast Guard as the United States government representative. The Chief of the Eleventh Coast Guard District's Marine Safety Division (having Federal marine safety oversight responsibilities for the State of California) was contacted and briefed on the OTTER program. He stated that he believed that IMO would have no comment to make on the substance of the Act or the OTTER form. He also believed that it was not necessary to contact IMO, and stated that further attempts to contact the IMO directly would be unsuccessful as the IMO does not address matters of individual states within a nation. Therefore, there was no direct input from the International Maritime Organization.

CSLC staff first met with the TAG on March 4, 2003, to discuss the suitability of the draft form. At the first meeting, TAG members requested a further period of time to study the requirements and make their recommendations. Commission staff and the TAG later met on July 24, 2003. After extensive review of the draft form, the TAG agreed upon the final form which is presented as Appendix II to this report.

The OTTER Form was adopted by the Commission at its meeting on April 5, 2004 and has been made available for use by the industry. The OTTER form is posted on the State Lands Commission's webpage for the convenience of owners of oil and responsible parties.

## **ESTIMATION OF AIR EMISSIONS**

To estimate the amount of air emissions, the Act requires using, to the extent practicable, emission factors developed by the United States Environmental Protection Agency (USEPA). In February 2000 the USEPA passed a rule that sets emission standards for marine diesel engine emission standards. The standards are for new engines and take effect in 2004, 2005 and 2007, depending on the displacement (kilowatt rating or brake horse power) of the engines. A copy of a USEPA document which includes a table for Emission Standards and Dates for Marine Diesel Engines is attached to this report as Appendix III.

For existing vessels not covered by the USEPA standard, it was necessary to develop formulas for estimating air emissions. WSPA, which has extensive experience in marine transportation, in cooperation with a Technical Advisory Group and consulting engineers, developed the necessary formulas and conversion factors. The emissions are based on the displacement of the marine propulsion units. The tables have been developed from engineering calculations and surveys of existing vessels. They were independently reviewed and have been widely accepted as providing an acceptable estimation of vessel emissions. The tables have been distributed to owners of oil and



responsible parties for their use. The types of emissions in this report include nitrogen oxides, hydrocarbons, particulate matter and carbon monoxide. The tables can be found in Appendix IV.

## **VOYAGE ROUTES**

The Act requires the reporting of vessel routes. Tank ships and barges typically travel on routes that are prescribed distances from shore based upon agreements between the oil industry and state government agencies. Most barges travel in the internationally designated Traffic Separation Scheme (TSS) in the Santa Barbara Channel and travel up the coast. On these voyages, tank vessels are generally 12 to 15 nautical miles off-shore. Most tank ships travel at a distance greater than 25 miles off-shore. For simplicity of reporting it was decided to use the designation "S" for vessels utilizing the Santa Barbara Channel TSS. For the others, "O" is used to designate an off-shore voyage. If a different type of route is used, it is to be reported by a notation to the OTTER Form.

## **CONFIDENTIALITY**

During meetings with WSPA, some members expressed concern regarding the confidentiality of the reported information in the context of it affecting the competitiveness of their businesses. They stated that they did not want their throughput figures made public. However, CSLC staff assured them that the statute adequately addressed their concerns. PRC Section 8788 requires that "Any information collected under this division for the purpose of explaining why the oil was transferred shall be kept confidential and reported only in the aggregate by the commission, in a manner that protects the competitive nature of the information."

## **OUTREACH TO THE INDUSTRY**

In October 2003, the CSLC Marine Facilities Division (MFD) held two customer service meetings to publicize the OTTER program and the OTTER Form. The first meeting was in Martinez, the center of the oil industry in the San Francisco Bay, and the second was in Long Beach. At these meetings, MFD staff made presentations explaining the OTTER program and the information required to be provided, and the OTTER Form. Question and answer sessions were used to further clarify the requirements of the OTTER program.

Before the end of the year 2003, CSLC staff established telephone contact with persons who would be responsible for transmitting the OTTER reports.

As explained in the section below, there were several problems encountered with the initial reports that were received by the Commission. Staff had to conduct extensive individual outreach to several persons compiling OTTER reports. This was typically done by telephone with follow-up by e-mail to provide documentation for the reporters to retain for their use.

The Act requires responsible parties to submit OTTER reports to the commission on a quarterly basis. Some responsible parties submit them monthly. About two weeks before the end of each quarter, CSLC staff contact the known responsible parties both by telephone and by e-mail to remind them to submit their quarterly OTTER reports in a timely manner.

## **DIFFICULTIES ENCOUNTERED IN IMPLEMENTING THE OTTER PROGRAM**

The collection of OTTER program information commenced effective January 2004. At the start, there were numerous telephone and e-mail inquiries. There were several questions regarding the term "internal shipment of oil." Also, numerous questions were asked about who should file the report. Essentially, in a transaction of oil, there may be three owners or more depending upon contractual arrangements. The first owner is the shipper of the oil. When the oil is transferred to the vessel, the ownership temporarily transfers to the master of the vessel until it is discharged at the receiving terminal. The third owner of the oil is the party receiving the oil. Questions were raised as to when and who should file the OTTER Form. During the meetings with WSPA, this subject was discussed and it was generally accepted that the report should be filed after the discharge of oil to its consignee is completed. This would also protect against the possibility of multiple reporting of the same shipment of oil.

As to the question of who should file reports, it was a more complex matter. Certain shipments of oil are transferred from terminal to terminal owned by the same company. In such cases, the owners would remain the same entity. Others are shipped to new owners. Some shipments are partially offloaded to two or more owners. For example, a shipment may originate at a terminal in the San Francisco Bay with part of it being offloaded to one owner in the port of Los Angeles and the other to another owner in the port of Long Beach. After some discussion the TAG agreed that shippers and receivers of oil should enter into agreements as to who will be responsible for filing OTTER reports. Initially, at the start of the program during the first quarter of 2004, there were several duplicate reports received by the CSLC of the same shipment. Staff had to carefully check each vessel's departure and arrival dates and times to eliminate duplicate reports. Staff had to contact those reporters and explain to them that both parties would have to agree as to who would file future reports. The duplicate reporting of internal shipments had been eliminated by the end of 2004. As a double check, independent verification of vessel arrivals was accomplished by reviewing the Marine Exchange lists of vessel arrivals and departures from California ports as well as other sources of information.

In most cases, OTTER reports are prepared by logistics or accounting staff of oil companies. These persons must have all the information given to them so that they can correctly fill out the OTTER form before submission to the CSLC. The amounts and types of oil shipped and consigned are provided by terminal staff at each end of the voyage. The dates and times of travel and the route taken are provided by the vessel operator transporting the internal shipment. The type of engine, the engine fuel and the

air emissions are also provided by the vessel operator. All this information has to be collected, collated and entered on the OTTER form prior to filing with the Commission.

There are only a few tank ships that engage in transporting internal shipments of oil. However, there are many barges involved. Barges are not equipped with self-propulsion mechanisms and have to use tugboats to tow them to their destination. Barges often employ different tugboats for different voyages. The types of engines and fuel are different for each tugboat. Also, air emission figures are different for each tugboat. The collection, collation and reporting of this information is not an easy task for logistics and accounting personnel.

During the first quarter of 2004, there were many difficulties encountered in reporting the emissions from vessels. Some tugboat owners were not aware of the emission factors of their tugboats. They contacted their shipbuilders and naval architects to obtain this information. Others had to have their tugboats surveyed by a classification society to obtain emission factors.

Air emissions are generally reported by their quantities in short tons. Vessel emissions during a voyage are obtained by multiplying the emission factor by the duration of time the engine has been operating to obtain the emissions in grams per kilowatt hour. This is then converted to short tons by dividing it by a conversion factor. Although the standard international convention today is to express engine power in terms of kilowatts, some of the older vessels and tugboats have their power ratings in brake horse power. Owners of these vessels have had to convert their power rating from brake horse power to the conventional rating of kilowatts before providing information to the persons preparing the OTTER report.

During the first half of 2004, several persons who were appointed to compile OTTER reports contacted CSLC staff. Many of them wanted to know how this information could be obtained. Staff provided guidelines and instructions to those persons. Initially, there were several problems with calculating emissions and conversion of power units. During the first quarter, staff had to check each and every emission calculation. When errors were found, staff interacted with the persons reporting with a view towards correcting such errors and preventing recurrence in the future. There were several instances when the correct information was not immediately available. Often the person contacted for that information had to procure it from a vessel operator's headquarters on the east coast.

Communication and outreach by CSLC staff has worked to create a relationship educated the reporters of OTTER information. By the end of calendar year 2004, these difficulties had been overcome.

## THE OTTER DATABASE

The information received by the commission is entered into an electronic database. At the end of each quarter the information is aggregated and entered into a table. At the end of the year, the table enables staff to prepare the mandated annual report to the legislature. It also allows staff to compare quarterly trends in the internal shipments of oil. Additionally, raw data in the OTTER Database has already been of value to some state and local planning agencies.

## REPORT TO THE LEGISLATURE

The Act requires the CSLC to submit a report to the Legislature and to make the report available to other parties requesting it. Annual reports are to be filed with the legislature on or before April 1, each year for the years 2004 to 2009.

The Act requires the Annual Reports to include, at a minimum, the following:

- (1) A description of any trends in the total number of trips by oil type, amount of shipment, and source of oil.
- (2) The number of transfers due to refinery shutdowns.
- (3) The location of air emissions and ballast discharge, and the type of vessel used during those events.
- (4) A discussion of any other pertinent issues that the Commission determines should be included.

## Oil Transfer and Transportation Emission and Risk Reduction Act Statistics for 2004

### ANNUAL SUMMARY 2004 – VOYAGES

|   |     |
|---|-----|
| Total number of internal shipment voyages:                          | 365 |
| Number of voyages from San Francisco Bay to Los Angeles/Long Beach: | 241 |
| Number of voyages from Los Angeles/Long Beach to San Francisco Bay: | 101 |
| Number of voyages from Ellwood to Long Beach:                       | 16  |
| Number of voyages from Ellwood to San Francisco Bay:                | 3   |
| Number of voyages from El Segundo Marine Terminal to Long Beach:    | 4   |
| Number of offshore voyages (O) : > 25 nautical miles from land      | 161 |
| Number of coastal voyages (S): 12 to 15 nautical miles from land    | 204 |

The following table is a compilation of all submitted OTTER information for Calendar Year 2004.

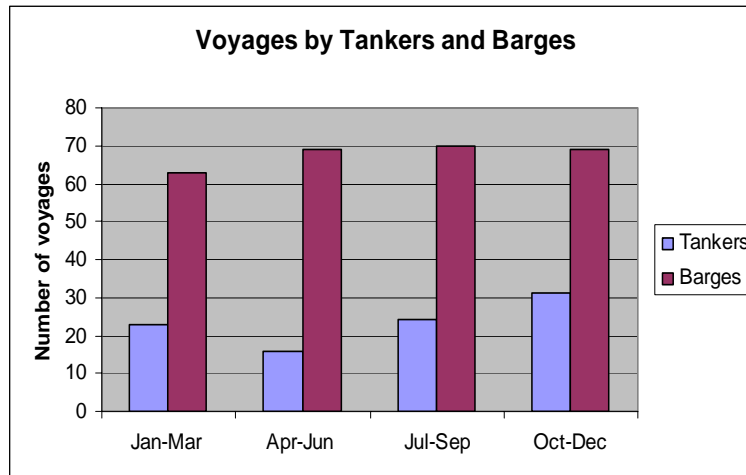
# FIRST ANNUAL OTTER REPORT 2004

## Annual Statistics Table

| Items   | 1 <sup>st</sup> .<br>Quarter | 2 <sup>nd</sup> .<br>Quarter | 3 <sup>rd</sup> .<br>Quarter | 4 <sup>th</sup> .<br>Quarter | Aggregate<br>Year 2004 |
|---|------------------------------|------------------------------|------------------------------|------------------------------|------------------------|
| Total number of internal shipments of oil                             | 86                           | 85                           | 94                           | 100                          | 365                    |
| Number of internal shipments by tanker                                | 23                           | 16                           | 24                           | 31                           | 94                     |
| Number of internal shipments by barge/tug                             | 63                           | 69                           | 70                           | 69                           | 271                    |
| Number of barrels of crude oil shipped                                | 325,941                      | 49,761                       | 269,097                      | 326,250                      | 971,049                |
| Number of barrels of refined oil shipped                              | 9,448,770                    | 6,792,932                    | 7,972,181                    | 8,888,026                    | 33,101,909             |
| Number of barrels of other oil shipped                                | 0                            | 0                            | 0                            | 0                            | 0                      |
| Total NO <sub>x</sub> emissions in short tons                         | 291.754                      | 277.319                      | 340.381                      | 275.391                      | 1,184.845              |
| Total HC emissions in short tons                                      | 13.451                       | 12.074                       | 18.462                       | 15.988                       | 59.975                 |
| Total PM emissions in short tons                                      | 22.990                       | 15.448                       | 19.113                       | 25.545                       | 83.096                 |
| Total CO emissions in short tons                                      | 41.731                       | 43.022                       | 55.263                       | 35.891                       | 175.908                |
| NO <sub>x</sub> emissions 25 miles from coastline in short tons       | 214.861                      | 146.405                      | 199.408                      | 136.580                      | 697.253                |
| NO <sub>x</sub> emissions 12 to 15 miles from coastline in short tons | 76.893                       | 130.915                      | 140.973                      | 138.812                      | 487.593                |
| HC emissions 25 miles from coastline in short tons                    | 8.812                        | 7.271                        | 12.032                       | 10.306                       | 38.421                 |
| HC emissions 12 to 15 miles from coastline in short tons              | 4.637                        | 4.803                        | 6.43                         | 5.683                        | 21.553                 |
| PM emissions 25 miles from coastline in short tons                    | 12.637                       | 12.303                       | 11.772                       | 20.031                       | 56.741                 |
| PM emissions 12 to 15 miles from coastline in short tons              | 10.352                       | 3.147                        | 7.341                        | 5.514                        | 26.354                 |
| CO emissions 25 miles from coastline in short tons                    | 29.861                       | 26.270                       | 32.173                       | 19.549                       | 107.854                |
| CO emissions 12 to 15 miles from coastline in short tons              | 11.87                        | 16.752                       | 23.090                       | 16.342                       | 68.054                 |
| No. of internal shipments because of refinery breakdowns              | 0                            | 0                            | 0                            | 0                            | 0                      |

## Tank Vessels

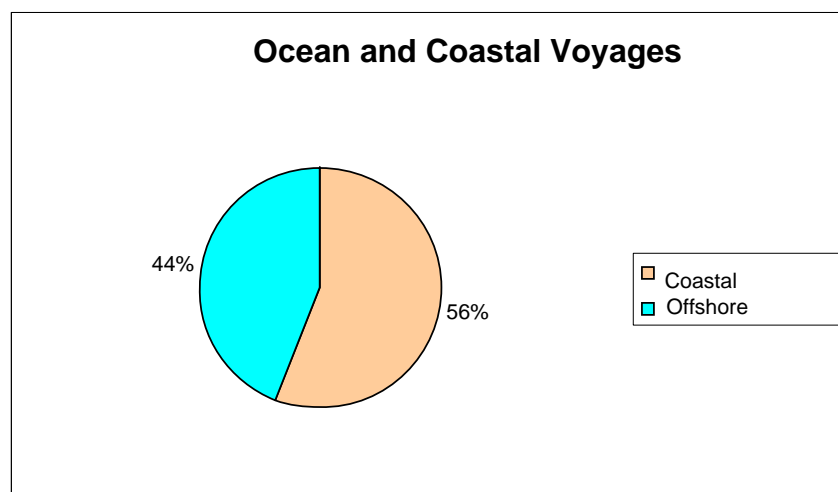
|  |     |
|--|-----|
| Total number of internal shipment voyages: | 365 |
| Voyages by tankers:                        | 94  |
| Voyages by barges:                         | 271 |



The data shows that there are approximately three times more internal shipments of oil by barge than there are by tank ship.

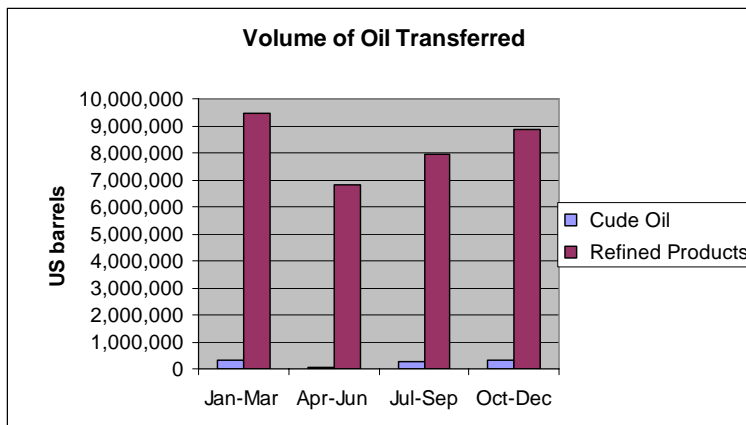
## Ocean and Coastal Voyages

Of the total voyages, 44% of were by the off-shore route, generally by tankers. This route keeps the vessel 25 or more nautical miles from the coast. There were 56% of the voyages undertaken on the coastal route from 12 to 15 nautical miles from the coast. This route is used by barges.



## Volume of Oil Transferred

Total Volume: 34,072,958 barrels  
 Crude oil: 971,049 barrels  
 Refined Oil: 33,101,909 barrels



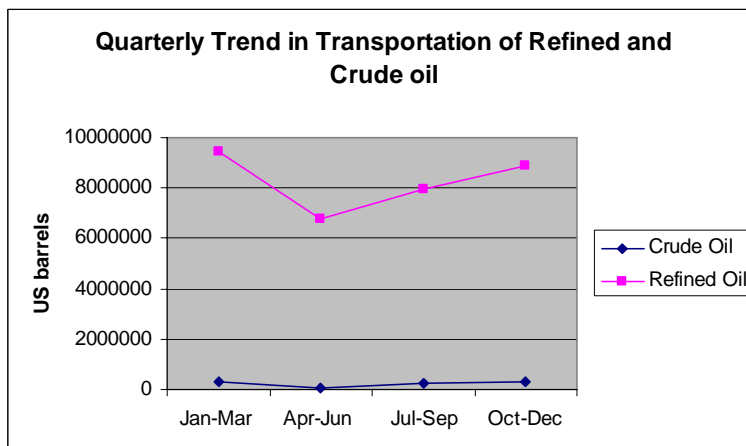
During 2004, all of the oil transported between the ports of the San Francisco Bay area and the Los Angeles/Long Beach area was refined products. No crude oil was shipped directly between these areas.

All internal shipments of crude oil in 2004 were from the Elwood marine terminal, off the Coast of Santa Barbara County to either the San Francisco Bay Area or the Los Angeles/Long Beach area.

## Type of Oil Transferred

**Crude Oil:** The crude oil transfer volume was highest in the fourth quarter at 326,250 barrels and least in the second quarter at 49,761 barrels.

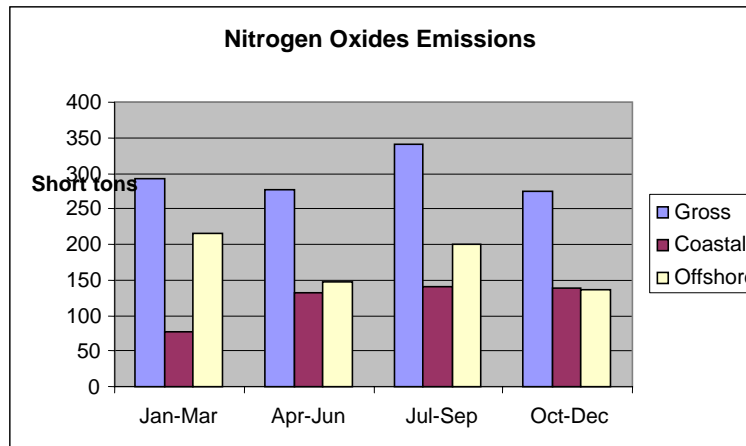
**Refined Oils:** The highest volume was transferred in the first quarter at 9,448,770 barrels and the least volume was transferred in second quarter at 6,792,932 barrels.



## **AIR EMISSIONS**

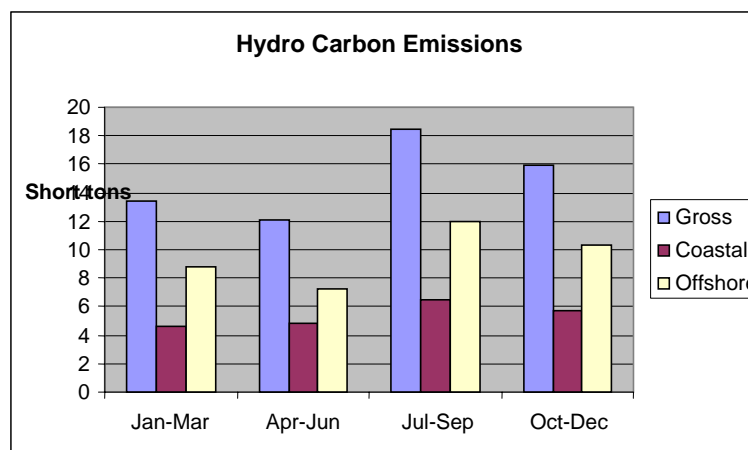
### **Nitrogen Oxide Emissions (NO<sub>x</sub>)**

The NO<sub>x</sub> emissions were the highest in the third quarter when there were 94 shipments in comparison to 100 shipments in the fourth quarter. In the fourth quarter there was no significant difference in contribution of NO<sub>x</sub> emissions from vessels using the off-shore voyage route and those vessels using the coastal voyage route.



### **Hydrocarbon Emissions (HC)**

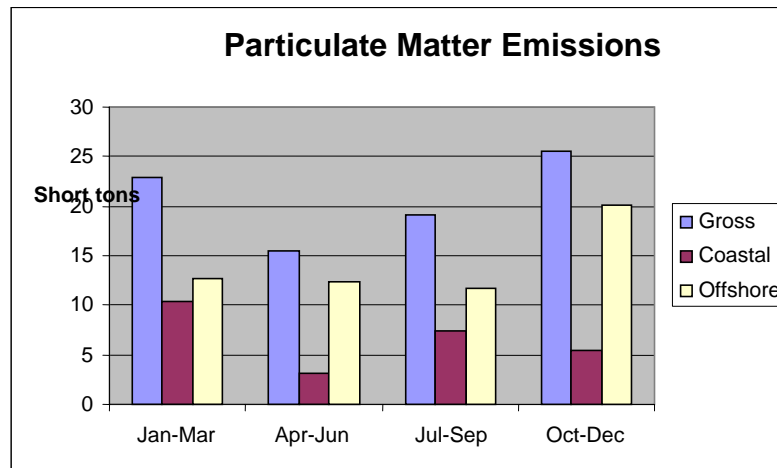
HC emissions were highest in the third quarter. The vessels using the off-shore voyage route emitted more HC gases than those vessels using the coastal voyage route.





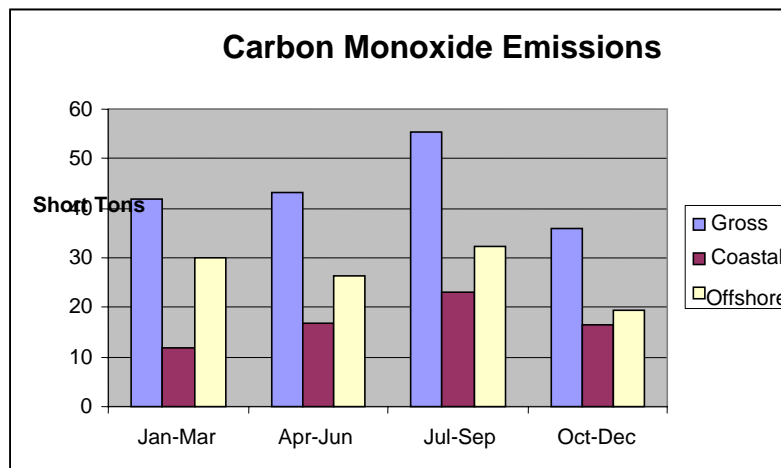
## Particulate Matter Emissions (PM)

PM emissions were highest in the fourth quarter because of highest number of voyages in the fourth quarter. The PM emission in all quarters remained higher from the vessels using the off-shore voyage route than those vessels using the coastal voyage route.



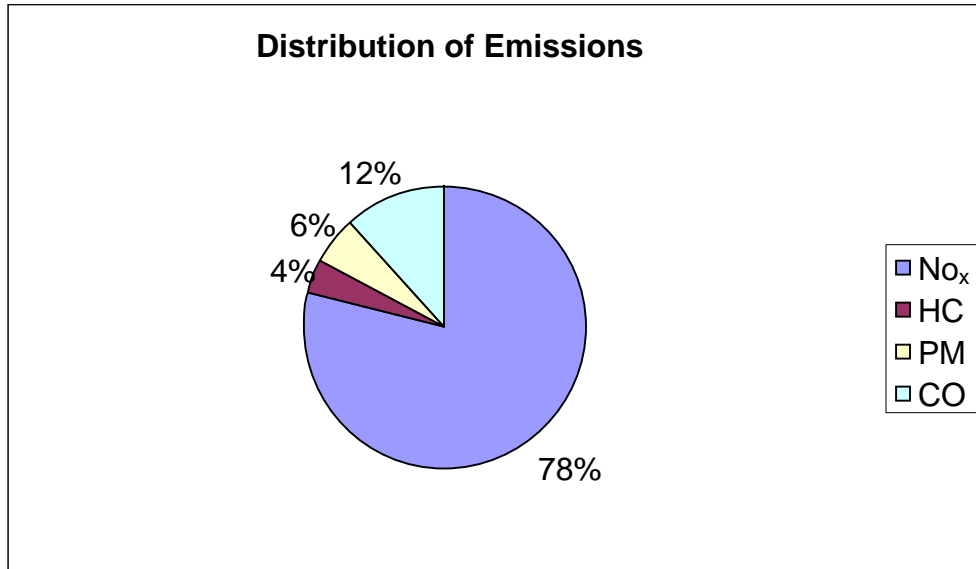
## Carbon Monoxide Emissions (CO)

The highest quantity of CO was emitted during the third quarter of 2004. Vessels navigating the off-shore voyage route emitted higher quantities of CO than those taking the coastal route.



## Distribution of Emissions

NO<sub>x</sub> emission: 1,184.845 short tons or 78% of total emissions  
HC emissions: 54.523 short tons or 4% of total emissions  
PM emissions: 80.801 short tons or 6% of total emissions  
CO emissions: 159.259 short tons or 12% of total emissions



## **CONCLUSION**

The Oil Transfer and Transportation Emission and Risk Reduction Act has been successfully implemented and the owners of oil and designated responsible parties are properly reporting the required information. Independent verification of vessel arrivals was accomplished by double checking against the Marine Exchange lists of vessel arrivals and departures from California ports as well as other sources of information.

The information collected by the OTTER Program did not previously exist. The number of voyages moving oil between California's ports, the amount of oil transferred and the estimated air emissions are important factors in the environmental impacts of oil transportation. Now, planning organizations, State and Federal Agencies and organizations developing information, particularly for environmental documentation, will have a much more complete picture of the movement of oil along the California coast. The information in this first report stands alone. But, continued collection of OTTER information will allow future reports to look at trends and changes in oil transportation, estimates of vessel air emissions along our central coast and will allow planners to more exactly examine the impacts of moving oil by marine vessels.

## **APPENDIX I**

The Oil Transfer and Transportation Emission and Risk Reduction Act of 2002

## LEGISLATIVE COUNSEL'S DIGEST

AB 2083, Jackson. Public resources: oil spill prevention and response. Existing law establishes oil spill prevention, inspection, response, containment, and cleanup programs.

This bill would require the State Lands Commission to develop a form that is to be completed by the responsible party, as defined, engaged in the internal shipment of oil. The form would be designed to enable the commission to obtain and track the amount and type of oil transported, as well as the name of the vessel, the vessel's route, and air emissions relating to the internal shipment of that oil.

The bill would require the commission, on or before April 1 of each year, for the calendar years 2004 to 2009, inclusive, to file a report with the Legislature summarizing certain information and transmit a copy of the report to any interested agency or member of the public, upon request.

The bill would require the commission to consult with the administrator for oil spill response, other state agencies, and agencies of the federal government, including the United States Coast Guard and the federal Department of Transportation, to the maximum extent feasible, before undertaking actions under these provisions.

The bill would require the administrator to reimburse the commission for the costs of administering these provisions from the Oil Spill Prevention and Administration Fund.

These provisions would be repealed on January 1, 2010.

### DIVISION 7.9. OIL TRANSFER AND TRANSPORTATION EMISSION AND RISK REDUCTION ACT OF 2002

8780. This division shall be known and may be cited as the Oil Transfer and Transportation Emission and Risk Reduction Act of 2002.

8781. The Legislature finds and declares all of the following:

(a) Thirty years ago the people of California passed the California Coastal Zone and Conservation Act of 1972 after a disastrous oil spill that affected hundreds of miles of coast and severely affected the coastal economy.

(b) A clean and healthy coastal environment is critical to maintaining a vibrant coastal economy, including opportunities for sustainable fisheries, flourishing tourism, and healthy recreation.

(c) The coastal communities contribute billions of dollars and hundreds of thousands of jobs to the state economy.

(d) Much of the oil extracted off California's coast is highly viscous, the refining of which results in heavy byproducts such as fuel oil and coke, which tend to be shipped to overseas markets. The storage and shipment of such byproducts will also have air quality impacts.

(e) There is significant internal shipment of oil by vessel between the San Francisco Bay area and the Los Angeles area.

(f) Although vessels transporting oil are eventually required to be double hulled, this will not be completed until January 1, 2015.

(g) The thousands of sea birds that have been injured or killed in 2001 and 2002 by oil leaking from a freighter that sank off California's coast in 1953 are a strong reminder of the serious consequences of vessel mishaps.

(h) One of the results of vessel traffic along the central coast and into the ports of the Los Angeles and San Francisco areas is tons of oxides of nitrogen emitted into the air each day, which could negate efforts made on land to meet federal ozone standards and other public health air quality goals.

(i) Current, accessible and accurate data regarding oil transportation is critical to having adequate information of the potential environmental quality, public health, and environmental justice consequences that must be analyzed by state and local agencies for environmental impact reports and statements, emergency response planning, permit issuance, and air quality mitigation efforts.

(j) Tracking trends in internal shipment of oil is necessary to promote public safety, health, and welfare, and to protect public and private property, wildlife, marine fisheries, and other ocean resources, and the natural environment in order to protect and to preserve the ecological balance of California's coastal zone, coastal waters, and coastal economy.

8782. Unless the context requires otherwise, the following definitions govern the construction of this division:

(a) "Administrator" means the administrator for oil spill response appointed by the Governor under Section 8670.4 of the Government Code.

(b) "Barge" means any vessel that carries oil in commercial quantities as cargo but is not equipped with a means of self-propulsion.

(c) "Commission" means the State Lands Commission.

(d) "Internal shipment of oil" means the loading, transporting by vessel, and offloading of oil that originates and terminates at the San Francisco Bay area and the Los Angeles

and Long Beach area, or points in between. Internal shipment of oil does not include lightering, as defined in paragraph (4) of subdivision (l) of Section 790 of Title 14 of the California Code of Regulations.

(e) "Marine facility" means any facility of any kind, other than a vessel, that is or was used for the purpose of exploring for, drilling for, producing, storing, handling, transferring, processing, refining, or transporting oil and is located in marine waters, or is located where a discharge could impact marine waters, unless the facility (1) is subject to Chapter 6.67 (commencing with Section 25270) or Chapter 6.75 (commencing with Section 25299.10) of Division 20 of the Health and Safety Code or (2) is placed on a farm, nursery, logging site, or construction site and does not exceed 20,000 gallons in a single storage tank. A drill ship, semisubmersible drilling platform, jack-up type drilling rig, or any other floating or temporary drilling platform is a "marine facility." A small craft refueling dock is not a "marine facility."

(f) "Marine terminal" means any facility used for transferring oil to or from tankers or barges. A marine terminal includes all piping not integrally connected to a tank facility as defined in subdivision (k) of Section 25270.2 of the Health and Safety Code.

(g) "Oil" means any kind of petroleum, liquid hydrocarbons, or petroleum products or any fraction or residues therefrom, including, but not limited to, crude oil, bunker fuel, gasoline, diesel fuel, aviation fuel, oil sludge, oil refuse, oil mixed with waste, and liquid distillates from unprocessed natural gas.

(h) "Operator," when used in connection with a vessel means any person or entity that owns, has an ownership interest in, charters, leases, rents, operates, participates in the operation of, or uses, that vessel.

(i) "Person" means an individual, trust, firm, joint stock company, or corporation, including, but not limited to, a government corporation, partnership, or association. "Person" also includes any city, county, city and county, district, commission, the state or any department, agency, or political subdivision thereof, and the federal government or any department or agency thereof to the extent permitted by law.

(j) "Responsible party" or "party responsible" means the "Responsible party" or "Party responsible" means the owner of the oil or a person or entity who accepts responsibility for the oil for purposes of this division.

(k) "Tanker" means any self-propelled, waterborne vessel, constructed or adapted for the carriage of oil in bulk or in commercial quantities as cargo.

(l) "Vessel" means a tanker or barge as defined in this section.

8783. (a) The commission shall develop a form that is to be completed by the responsible party engaged in the internal shipment of oil. The form shall be known as the "Oil Transfer and Transportation Emission and Risk Reduction Form." The form

shall be designed to enable the commission to obtain and track the amount and type of oil transported, as well as the name of the vessel, the vessel's route, and air emissions relating to the internal shipment of that oil.

(b) The form shall contain, but need not be limited to, all of the following information:

(1) The name, address, point of contact, and telephone number of the responsible party.

(2) The name of the vessel transporting the oil.

(3) The type and amount of oil being transported.

(4) The source of crude oil.

(5) The name and location of any terminal that loaded the vessel.

(6) The name and location of any terminal that discharged the tanker or barge.

(7) The dates of travel and the route.

(8) The type of engine and fuel used to power the tanker or barge-towing vessel.

(9) The estimated amount and type of air emissions. To the extent practicable, the emissions factors developed by the United States Environmental Protection Agency shall be used to estimate the amount of air emissions. The form shall be designed to ensure that charter vessel air emissions are not counted more than once.

(10) An indication of whether the reason for the internal shipping of oil was due to a temporary shutdown or partial shutdown of a key refinery facility.

(11) On and after January 1, 2004, if Division 36 (commencing with Section 71200) is repealed pursuant to Section 71271, the amount of any ballast discharge and the location of the discharge.

(c) The form shall be filed with the commission on a quarterly basis by the responsible party engaged in the internal shipment of oil for the activities of the preceding quarter.

(d) In developing the form and the reporting process, the commission shall consult with the interested parties including operators, responsible parties, and the International Maritime Organization.

8784. (a) On or before April 1 of each year, for the calendar years 2004 to 2009, inclusive, the commission shall file a report with the Legislature summarizing the information and including all of the following:



(1) A description of any trends in the total number of trips by oil type, amount of shipment, and source of oil.

(2) The number of transfers due to refinery shutdowns.

(3) The location of air emissions and ballast discharge, and the type of vessel used during those events.

(4) A discussion of any other pertinent issues that the commission determines should be included.

(b) The commission shall transmit a copy of the report to any interested agency or member of the public, upon request.

8785. The commission shall consult with the administrator, other state agencies, and agencies of the federal government, including, but not limited to, the United States Coast Guard and the federal Department of Transportation, to the maximum extent feasible, before undertaking actions under this division.

8786. The administrator shall reimburse the commission for the costs of administering this division from the Oil Spill Prevention and Administration Fund, pursuant to paragraph (8) of subdivision (e) of Section 8670.40 of the Government Code.

8787. This division applies to all terminals, pipelines, vessels, and activities in the state, whether on lands that have been granted by the Legislature to local governments or on lands that remain ungranted.

8788. Any information collected under this division for the purpose of explaining why oil was transferred shall be kept confidential and reported only in the aggregate by the commission, in a manner that protects the competitive nature of the information.

8789. This division shall remain in effect only until January 1, 2010, and as of that date is repealed, unless a later enacted statute, which is enacted before January 1, 2010, deletes or extends that date.

SEC. 3. Section 1.5 of this bill incorporates amendments to Section 8670.40 of the Government Code proposed by both this bill and SB 849. It shall only become operative if (1) both bills are enacted and become effective on or before January 1, 2003, (2) each bill amends Section 8670.40 of the Government Code, and (3) this bill is enacted after SB 849, in which case Section 1 of this bill shall not become operative.

## **APPENDIX II**

The Oil Transfer and Transportation Emission and  
Risk Reduction Form

# OIL TRANSFER AND TRANSPORTATION EMISSION AND RISK REDUCTION FORM

Public Resources Code - Sections 8780 through 8789

1/1/2004

Submission Date:

| Name of Vessel/Barge | IMO/Vessel ID No. |
|----------------------|-------------------|
|                      |                   |

| Name of Loading Terminal | Location |
|--------------------------|----------|
| 1.                       |          |
| 2.                       |          |
| 3.                       |          |

| Cargo Transported | Quantity (BBLs) | Source (Crude only) |
|-------------------|-----------------|---------------------|
| 1.                |                 |                     |
| 2.                |                 |                     |
| 3.                |                 |                     |

| Name of Discharge Terminal | Location |
|----------------------------|----------|
| 1.                         |          |
| 2.                         |          |
| 3.                         |          |

| Dates of Travel |      |       |         |      |
|-----------------|------|-------|---------|------|
| Departure       | Time | Route | Arrival | Time |
|                 |      |       |         |      |

| Engine Type (Tanker) | Engine Type (Barge/Tug) | Engine Fuel |
|----------------------|-------------------------|-------------|
|                      |                         |             |

| Engine Air Emissions (g/kw-hr) |    |    |    |
|--------------------------------|----|----|----|
| NO <sub>x</sub>                | HC | PM | CO |
|                                |    |    |    |

|   |                              |                             |
|---|------------------------------|-----------------------------|
| Was the reason for shipping this cargo due to a temporary or partial shutdown of a key refinery facility? | Yes <input type="checkbox"/> | No <input type="checkbox"/> |
|---|------------------------------|-----------------------------|

| Point of Contact               |  |
|--------------------------------|--|
| Address                        |  |
|                                |  |
|                                |  |
| Telephone No.                  |  |
|                                |  |
| Signature of Responsible Party |  |

## INSTRUCTIONS

1. The responsible party of an "internal shipment" {Public Resources Code §8782(d)} of oil from either the San Francisco Bay area or Los Angeles/Long Beach areas or ports in between shall be responsible for filing the form with the California State Lands Commission's Marine Facilities Division. As provided by Public Resources Code §8788, the information provided by the responsible party through the form shall be kept confidential and reported only in the aggregate by the Commission, as provided by Public Resources Code §8784, in a manner that protects the competitive nature of the information.
2. **Loading Terminal** - The name of each terminal loading an internal shipment of oil.
3. **Location of Terminal** - Either 'A' - San Francisco Bay area; 'B' - Los Angeles/Long Beach area; or 'C' - name of port if not 'A' or 'B'.
4. **Cargo Transported** - Types indicated in broad categories, such as: CRUDE OIL, REFINED OIL, or OTHER (please specify).
5. **Source** - The source or origin of oil should be entered only if the oil shipped is crude oil.
6. **Dates of Travel** - The date and time of departure from the last loading terminal in areas 'A' or 'B' or 'C' (see 3. above) and the date and time of arrival at the first discharge terminal of the internal shipment.
7. **Route** - 'S' - Standard route using the Santa Barbara Channel Traffic Separation Schemes; 'O' - Offshore route at least 25 miles from the coastline; if neither 'S' nor 'O', a brief explanation.
8. **Engine Type** - The types of engines for main propulsion. Types include INTERNAL COMBUSTION, GAS TURBINE and STEAM.
9. **Engine Fuel** - The type of fuel used by the tanker or tug, e.g., DIESEL, FUEL OIL, HEAVY FUEL OIL, BUNKER 'C' or GAS OIL.
10. **Air Emissions** - For estimating air emissions, use either individual vessel emission factors or those found in USEPA's Document "Compilation of Air Pollutant Emission Factors, AP-42." Reported emissions are for main propulsion unit only and for the transit time of vessel or barge.
11. The responsible party should submit completed forms by mail or fax within 45 days of the end of each calendar quarter to: California State Lands Commission, Marine Facilities Division, 200 Oceangate, Suite 900, Long Beach, CA 90802. Fax (562) 499-6317.

## **APPENDIX III**

EPA Technical Highlights;  
Emission Standards for Marine Diesel Engines: Scope of Application



# Technical Highlights

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## Emission Standards for Marine Diesel Engines: Scope of Application

The U.S. Environmental Protection Agency's (EPA) final rule for commercial marine diesel engines sets emission standards that apply to new engines used in the United States. These standards take effect for new engines manufactured starting in 2004, 2005, or 2007, depending their size (see Table 1). This fact sheet addresses companies that produce these engines.

### **How does EPA distinguish marine and non-marine diesel engines?**

We define a marine diesel engine as one that is "installed on" a marine vessel. A loose engine that someone intends to install on a marine vessel is also a marine diesel engine if its fueling, cooling, and exhaust systems are integral to the vessel.

### **Do the emission standards apply to remanufactured engines?**

Generally no. Our requirements don't affect marine engines you produce and sell before the new standards take effect, with three exceptions:

1. if you remanufacture a land-based engine for installation on a marine vessel, or
2. if you remanufacture any engine for installation in a new vessel, or
3. if anyone imports an uncertified engine installed (or to be installed) on a vessel.

In the first two cases, we treat the engine as a new marine engine that must meet standards when you remanufacture it. Also, if you try to install a used engine in a new vessel (or a land-based engine in any vessel) without remanufacturing it, the emission standards in effect at the time of installation would apply to that engine. For an imported

engine, we apply the marine engine standards, if any, in effect when it was freshly manufactured.

### **What is a “new vessel”?**

A new vessel is one that is freshly manufactured or on whose value at the point of sale is at least 50 percent from new parts and construction. This includes vessels that recycle selected components and refurbished vessels that are so extensively overhauled that the majority of the resale value is from the new construction.

### **What about remanufacturing EPA-certified engines?**

Anyone rebuilding or remanufacturing a certified engine must bring it back to its original configuration. See the fact sheet on rebuilding diesel engines for more information (EPA420-F-99-045). We do not expect anyone to certify or re-certify these remanufactured engines.

### **What if my customer wants to repower a vessel with a new engine?**

If you make a new marine engine to replace another one, it must meet any emission standards in effect when you finish assembling it. However, if we agree no engine is available (from you or any other manufacturer) with the physical and performance characteristics needed for that installation, we will allow you to produce an uncertified engine. You must label the new engine and collect the one you’re replacing.

### **What is the foreign-trade exemption?**

If someone wants to install a new marine diesel engine on a U.S.-flagged vessel for overseas operation, you may ask us to exempt it. You must get a letter from the buyer of the new vessel showing it will operate mainly overseas. The buyer can do this in one of two ways:

- (1) Show that at least 75 percent of the engine’s operation will occur more than 320 nautical kilometers outside the U.S., not including trips between U.S. ports in Alaska, Hawaii, the continental U.S., or its territories.
- (2) Show the vessel has (or will have) solely a registry endorsement so it’s clear the vessel won’t operate between two U.S. ports.

### **What if I modify a new engine that is already certified to meet land-based requirements for installation in a marine vessel?**

You may qualify for the engine dressing exemption. For more information, see 40 CFR 94.907. See the earlier question about remanufacturing land-based engines for marine vessels.

### **What about recreational marine diesel engines?**

A recreational marine diesel engine is one you intend to be installed on a recreational vessel. The emission standards in this final rule don’t apply to these engines, but you must label them to show they’re for recreational vessels. We will propose separate emission standards for recreational engines.

## What other exemptions are available?

The final rule for commercial marine diesel engines includes several other exemptions, many of which are common to other programs. See 40 CFR 94, Subparts I and J for more information about how we handle each of these exemptions.

1. **Competition exemption:** for engines used solely for competition.
2. **National security exemption:** for combat-related applications.
3. **Testing exemption:** for your specific testing programs with uncertified engines.
4. **Manufacturer-owned engine exemption:** for engines you keep to further develop your product.
5. **Display exemption:** for engines that are strictly for observation.
6. **Export exemption:** for engines you export to other countries (as long as they don't adopt our standards).
7. **Incomplete engine exemption:** for loose, uncertified engines you import to convert into a certified marine configuration.

## How do I get more information?

You can get electronic documents on emission standards for marine diesel engines on the Office of Transportation and Air Quality web site at:

<http://www.epa.gov/otaq/marine.htm>

You can also contact Alan Stout at:

U.S. Environmental Protection Agency  
Office Transportation and Air Quality  
2000 Traverwood Drive  
Ann Arbor, MI 48105  
(734) 214-4805  
e-mail: [stout.alan@epa.gov](mailto:stout.alan@epa.gov)



**Table 1**  
**U.S. EPA Emission Standards and Dates for Marine Diesel Engines**

| Category | Displacement<br>(liters/cylinder)                      | Starting<br>Date | NO <sub>x</sub> +HC<br>(g/kW-hr) | PM<br>(g/kW-hr) | CO<br>(g/kW-hr) |
|----------|--|------------------|----------------------------------|-----------------|-----------------|
| 1        | power $\geq$ 37 kW<br>disp. <0.9                       | 2005             | 7.5                              | 0.40            | 5.0             |
|          | $0.9 \leq$ disp. <1.2                                  | 2004             | 7.2                              | 0.30            | 5.0             |
|          | $1.2 \leq$ disp. <2.5                                  | 2004             | 7.2                              | 0.20            | 5.0             |
|          | $2.5 \leq$ disp. <5.0                                  | 2007             | 7.2                              | 0.20            | 5.0             |
| 2        | $5.0 \leq$ disp. <15                                   | 2007             | 7.8                              | 0.27            | 5.0             |
|          | $15 \leq$ disp. <20,<br>and<br>Power <3300<br>kW       | 2007             | 8.7                              | 0.50            | 5.0             |
|          | $15 \leq$ disp. <20,<br>and<br>power $\geq$ 3300<br>kW | 2007             | 9.8                              | 0.50            | 5.0             |
|          | $20 \leq$ disp. <25                                    | 2007             | 9.8                              | 0.50            | 5.0             |
|          | $25 \leq$ disp. <30                                    | 2007             | 11.0                             | 0.50            | 5.0             |
|          |  |                  |                                  |                 |                 |

## **APPENDIX IV**

### **The Vessel Emission Estimation Form**

**WSPA Marine  
Vessel  
Emission  
Estimation  
Form  
Low Sulfur  
Diesel Fuel -  
0.05% Sulfur**

Location/Port:

Vessel Name:

Submission Date:

| Main Engines        |                                   |       |
|---------------------|-----------------------------------|-------|
|                     |                                   | Units |
| Total Engine Rating | 1000                              | BHP   |
| Fuel Type           | Low Sulfur Diesel<br>0.05% Sulfur |       |
| Hours Operation     | 10                                | Hours |
| Load                | 100                               | %     |

| Generator/Auxiliary |                                      |       |
|---------------------|--------------------------------------|-------|
|                     |                                      | Units |
| Total Engine Rating | 100                                  | BHP   |
| Fuel Type           | Low Sulfur<br>Diesel 0.05%<br>Sulfur |       |
| Hours Operation     | 10                                   | Hours |
| Load                | 100                                  | %     |

**MAIN ENGINES  
EMISSIONS**

| Pollutant                             | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|---------------------------------------|-------------|-------|-------|-------|-------|------------|
| Type                                  | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO <sub>2</sub> ) | 15.754      | 15.8  | 34.7  | 158   | 347   | 0.17       |
| ROC (as CH <sub>4</sub> )             | 0.932       | 0.9   | 2.1   | 9     | 21    | 0.01       |
| Carbon Monoxide (CO)                  | 2.864       | 2.9   | 6.3   | 29    | 63    | 0.03       |

|                        |         |       |         |       |        |      |
|------------------------|---------|-------|---------|-------|--------|------|
| Sulfur Dioxide (SO2)   | 0.199   | 0.2   | 0.4     | 2     | 4      | 0.00 |
| Particulates (as PM10) | 0.941   | 0.9   | 2.1     | 9     | 21     | 0.01 |
| Carbon Dioxide (CO2)   | 631.089 | 631.1 | 1,391.3 | 6,311 | 13,913 | 6.96 |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### GENERATOR/AUXILIARY EMISSIONS

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 1.6   | 3.5   | 16    | 35    | 0.02       |
| ROC (as CH4)             | 0.932       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Monoxide (CO)     | 2.864       | 0.3   | 0.6   | 3     | 6     | 0.00       |
| Sulfur Dioxide (SO2)     | 0.199       | 0.0   | 0.0   | 0     | 0     | 0.00       |
| Particulates (as PM10)   | 0.941       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Dioxide (CO2)     | 631.089     | 63.1  | 139.1 | 631   | 1,391 | 0.70       |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### COMBINED EMISSIONS - GRAND TOTAL

| Pollutant                |  |  |  | Total | Total  | Grand Total |
|--------------------------|--|--|--|-------|--------|-------------|
| Type                     |  |  |  | kg    | lb     | short tons  |
| Nitrogen Oxides (as NO2) |  |  |  | 173   | 382    | 0.19        |
| ROC (as CH4)             |  |  |  | 10    | 23     | 0.01        |
| Carbon Monoxide (CO)     |  |  |  | 32    | 69     | 0.03        |
| Sulfur Dioxide (SO2)     |  |  |  | 2     | 5      | 0.00        |
| Particulates (as PM10)   |  |  |  | 10    | 23     | 0.01        |
| Carbon Dioxide (CO2)     |  |  |  | 6,942 | 15,304 | 7.65        |

**WSPA Marine  
Vessel  
Emission  
Estimation  
Form  
Low Sulfur  
Diesel Fuel -  
0.05% Sulfur**

Location/Port:

Vessel Name:

Submission Date:

| Main Engines        |                                   |       |
|---------------------|-----------------------------------|-------|
|                     |                                   | Units |
| Total Engine Rating | 1000                              | BHP   |
| Fuel Type           | Low Sulfur Diesel<br>0.05% Sulfur |       |
| Hours Operation     | 10                                | Hours |
| Load                | 100                               | %     |

| Generator/Auxiliary |                                      |       |
|---------------------|--------------------------------------|-------|
|                     |                                      | Units |
| Total Engine Rating | 100                                  | BHP   |
| Fuel Type           | Low Sulfur<br>Diesel 0.05%<br>Sulfur |       |
| Hours Operation     | 10                                   | Hours |
| Load                | 100                                  | %     |

**MAIN ENGINES  
EMISSIONS**

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 15.8  | 34.7  | 158   | 347   | 0.17       |
| ROC (as CH4)             | 0.932       | 0.9   | 2.1   | 9     | 21    | 0.01       |
| Carbon Monoxide (CO)     | 2.864       | 2.9   | 6.3   | 29    | 63    | 0.03       |

|                        |         |       |         |       |        |      |
|------------------------|---------|-------|---------|-------|--------|------|
| Sulfur Dioxide (SO2)   | 0.199   | 0.2   | 0.4     | 2     | 4      | 0.00 |
| Particulates (as PM10) | 0.941   | 0.9   | 2.1     | 9     | 21     | 0.01 |
| Carbon Dioxide (CO2)   | 631.089 | 631.1 | 1,391.3 | 6,311 | 13,913 | 6.96 |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### GENERATOR/AUXILIARY EMISSIONS

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 1.6   | 3.5   | 16    | 35    | 0.02       |
| ROC (as CH4)             | 0.932       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Monoxide (CO)     | 2.864       | 0.3   | 0.6   | 3     | 6     | 0.00       |
| Sulfur Dioxide (SO2)     | 0.199       | 0.0   | 0.0   | 0     | 0     | 0.00       |
| Particulates (as PM10)   | 0.941       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Dioxide (CO2)     | 631.089     | 63.1  | 139.1 | 631   | 1,391 | 0.70       |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### COMBINED EMISSIONS - GRAND TOTAL

| Pollutant                |  |  |  | Total | Total  | Grand Total |
|--------------------------|--|--|--|-------|--------|-------------|
| Type                     |  |  |  | kg    | lb     | short tons  |
| Nitrogen Oxides (as NO2) |  |  |  | 173   | 382    | 0.19        |
| ROC (as CH4)             |  |  |  | 10    | 23     | 0.01        |
| Carbon Monoxide (CO)     |  |  |  | 32    | 69     | 0.03        |
| Sulfur Dioxide (SO2)     |  |  |  | 2     | 5      | 0.00        |
| Particulates (as PM10)   |  |  |  | 10    | 23     | 0.01        |
| Carbon Dioxide (CO2)     |  |  |  | 6,942 | 15,304 | 7.65        |

**WSPA Marine  
Vessel  
Emission  
Estimation  
Form  
Low Sulfur  
Diesel Fuel -  
0.05% Sulfur**

Location/Port:

Vessel Name:

Submission Date:

| Main Engines        |                                   |       |
|---------------------|-----------------------------------|-------|
|                     |                                   | Units |
| Total Engine Rating | 1000                              | BHP   |
| Fuel Type           | Low Sulfur Diesel<br>0.05% Sulfur |       |
| Hours Operation     | 10                                | Hours |
| Load                | 100                               | %     |

| Generator/Auxiliary |                                      |       |
|---------------------|--------------------------------------|-------|
|                     |                                      | Units |
| Total Engine Rating | 100                                  | BHP   |
| Fuel Type           | Low Sulfur<br>Diesel 0.05%<br>Sulfur |       |
| Hours Operation     | 10                                   | Hours |
| Load                | 100                                  | %     |

**MAIN ENGINES  
EMISSIONS**

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 15.8  | 34.7  | 158   | 347   | 0.17       |
| ROC (as CH4)             | 0.932       | 0.9   | 2.1   | 9     | 21    | 0.01       |
| Carbon Monoxide (CO)     | 2.864       | 2.9   | 6.3   | 29    | 63    | 0.03       |

|                        |         |       |         |       |        |      |
|------------------------|---------|-------|---------|-------|--------|------|
| Sulfur Dioxide (SO2)   | 0.199   | 0.2   | 0.4     | 2     | 4      | 0.00 |
| Particulates (as PM10) | 0.941   | 0.9   | 2.1     | 9     | 21     | 0.01 |
| Carbon Dioxide (CO2)   | 631.089 | 631.1 | 1,391.3 | 6,311 | 13,913 | 6.96 |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### GENERATOR/AUXILIARY EMISSIONS

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 1.6   | 3.5   | 16    | 35    | 0.02       |
| ROC (as CH4)             | 0.932       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Monoxide (CO)     | 2.864       | 0.3   | 0.6   | 3     | 6     | 0.00       |
| Sulfur Dioxide (SO2)     | 0.199       | 0.0   | 0.0   | 0     | 0     | 0.00       |
| Particulates (as PM10)   | 0.941       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Dioxide (CO2)     | 631.089     | 63.1  | 139.1 | 631   | 1,391 | 0.70       |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### COMBINED EMISSIONS - GRAND TOTAL

| Pollutant                |  |  |  | Total | Total  | Grand Total |
|--------------------------|--|--|--|-------|--------|-------------|
| Type                     |  |  |  | kg    | lb     | short tons  |
| Nitrogen Oxides (as NO2) |  |  |  | 173   | 382    | 0.19        |
| ROC (as CH4)             |  |  |  | 10    | 23     | 0.01        |
| Carbon Monoxide (CO)     |  |  |  | 32    | 69     | 0.03        |
| Sulfur Dioxide (SO2)     |  |  |  | 2     | 5      | 0.00        |
| Particulates (as PM10)   |  |  |  | 10    | 23     | 0.01        |
| Carbon Dioxide (CO2)     |  |  |  | 6,942 | 15,304 | 7.65        |



**WSPA Marine  
Vessel  
Emission  
Estimation  
Form  
Low Sulfur  
Diesel Fuel -  
0.05% Sulfur**

Location/Port:

Vessel Name:

Submission Date:

| Main Engines        |                                   |       |
|---------------------|-----------------------------------|-------|
|                     |                                   | Units |
| Total Engine Rating | 1000                              | BHP   |
| Fuel Type           | Low Sulfur Diesel<br>0.05% Sulfur |       |
| Hours Operation     | 10                                | Hours |
| Load                | 100                               | %     |

| Generator/Auxiliary |                                      |       |
|---------------------|--------------------------------------|-------|
|                     |                                      | Units |
| Total Engine Rating | 100                                  | BHP   |
| Fuel Type           | Low Sulfur<br>Diesel 0.05%<br>Sulfur |       |
| Hours Operation     | 10                                   | Hours |
| Load                | 100                                  | %     |

**MAIN ENGINES  
EMISSIONS**

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 15.8  | 34.7  | 158   | 347   | 0.17       |
| ROC (as CH4)             | 0.932       | 0.9   | 2.1   | 9     | 21    | 0.01       |
| Carbon Monoxide (CO)     | 2.864       | 2.9   | 6.3   | 29    | 63    | 0.03       |

|                        |         |       |         |       |        |      |
|------------------------|---------|-------|---------|-------|--------|------|
| Sulfur Dioxide (SO2)   | 0.199   | 0.2   | 0.4     | 2     | 4      | 0.00 |
| Particulates (as PM10) | 0.941   | 0.9   | 2.1     | 9     | 21     | 0.01 |
| Carbon Dioxide (CO2)   | 631.089 | 631.1 | 1,391.3 | 6,311 | 13,913 | 6.96 |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### GENERATOR/AUXILIARY EMISSIONS

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 1.6   | 3.5   | 16    | 35    | 0.02       |
| ROC (as CH4)             | 0.932       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Monoxide (CO)     | 2.864       | 0.3   | 0.6   | 3     | 6     | 0.00       |
| Sulfur Dioxide (SO2)     | 0.199       | 0.0   | 0.0   | 0     | 0     | 0.00       |
| Particulates (as PM10)   | 0.941       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Dioxide (CO2)     | 631.089     | 63.1  | 139.1 | 631   | 1,391 | 0.70       |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### COMBINED EMISSIONS - GRAND TOTAL

| Pollutant                |  |  |  | Total | Total  | Grand Total |
|--------------------------|--|--|--|-------|--------|-------------|
| Type                     |  |  |  | kg    | lb     | short tons  |
| Nitrogen Oxides (as NO2) |  |  |  | 173   | 382    | 0.19        |
| ROC (as CH4)             |  |  |  | 10    | 23     | 0.01        |
| Carbon Monoxide (CO)     |  |  |  | 32    | 69     | 0.03        |
| Sulfur Dioxide (SO2)     |  |  |  | 2     | 5      | 0.00        |
| Particulates (as PM10)   |  |  |  | 10    | 23     | 0.01        |
| Carbon Dioxide (CO2)     |  |  |  | 6,942 | 15,304 | 7.65        |

**WSPA Marine  
Vessel  
Emission  
Estimation  
Form  
Low Sulfur  
Diesel Fuel -  
0.05% Sulfur**

Location/Port:

Vessel Name:

Submission Date:

| Main Engines        |                                   |       |
|---------------------|-----------------------------------|-------|
|                     |                                   | Units |
| Total Engine Rating | 1000                              | BHP   |
| Fuel Type           | Low Sulfur Diesel<br>0.05% Sulfur |       |
| Hours Operation     | 10                                | Hours |
| Load                | 100                               | %     |

| Generator/Auxiliary |                                      |       |
|---------------------|--------------------------------------|-------|
|                     |                                      | Units |
| Total Engine Rating | 100                                  | BHP   |
| Fuel Type           | Low Sulfur<br>Diesel 0.05%<br>Sulfur |       |
| Hours Operation     | 10                                   | Hours |
| Load                | 100                                  | %     |

**MAIN ENGINES  
EMISSIONS**

| Pollutant                             | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|---------------------------------------|-------------|-------|-------|-------|-------|------------|
| Type                                  | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO <sub>2</sub> ) | 15.754      | 15.8  | 34.7  | 158   | 347   | 0.17       |
| ROC (as CH <sub>4</sub> )             | 0.932       | 0.9   | 2.1   | 9     | 21    | 0.01       |
| Carbon Monoxide (CO)                  | 2.864       | 2.9   | 6.3   | 29    | 63    | 0.03       |

|                        |         |       |         |       |        |      |
|------------------------|---------|-------|---------|-------|--------|------|
| Sulfur Dioxide (SO2)   | 0.199   | 0.2   | 0.4     | 2     | 4      | 0.00 |
| Particulates (as PM10) | 0.941   | 0.9   | 2.1     | 9     | 21     | 0.01 |
| Carbon Dioxide (CO2)   | 631.089 | 631.1 | 1,391.3 | 6,311 | 13,913 | 6.96 |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### GENERATOR/AUXILIARY EMISSIONS

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 1.6   | 3.5   | 16    | 35    | 0.02       |
| ROC (as CH4)             | 0.932       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Monoxide (CO)     | 2.864       | 0.3   | 0.6   | 3     | 6     | 0.00       |
| Sulfur Dioxide (SO2)     | 0.199       | 0.0   | 0.0   | 0     | 0     | 0.00       |
| Particulates (as PM10)   | 0.941       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Dioxide (CO2)     | 631.089     | 63.1  | 139.1 | 631   | 1,391 | 0.70       |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### COMBINED EMISSIONS - GRAND TOTAL

| Pollutant                |  |  |  | Total | Total  | Grand Total |
|--------------------------|--|--|--|-------|--------|-------------|
| Type                     |  |  |  | kg    | lb     | short tons  |
| Nitrogen Oxides (as NO2) |  |  |  | 173   | 382    | 0.19        |
| ROC (as CH4)             |  |  |  | 10    | 23     | 0.01        |
| Carbon Monoxide (CO)     |  |  |  | 32    | 69     | 0.03        |
| Sulfur Dioxide (SO2)     |  |  |  | 2     | 5      | 0.00        |
| Particulates (as PM10)   |  |  |  | 10    | 23     | 0.01        |
| Carbon Dioxide (CO2)     |  |  |  | 6,942 | 15,304 | 7.65        |

**WSPA Marine  
Vessel  
Emission  
Estimation  
Form  
Low Sulfur  
Diesel Fuel -  
0.05% Sulfur**

Location/Port:

Vessel Name:

Submission Date:

| Main Engines        |                                   |       |
|---------------------|-----------------------------------|-------|
|                     |                                   | Units |
| Total Engine Rating | 1000                              | BHP   |
| Fuel Type           | Low Sulfur Diesel<br>0.05% Sulfur |       |
| Hours Operation     | 10                                | Hours |
| Load                | 100                               | %     |

| Generator/Auxiliary |                                      |       |
|---------------------|--------------------------------------|-------|
|                     |                                      | Units |
| Total Engine Rating | 100                                  | BHP   |
| Fuel Type           | Low Sulfur<br>Diesel 0.05%<br>Sulfur |       |
| Hours Operation     | 10                                   | Hours |
| Load                | 100                                  | %     |

**MAIN ENGINES  
EMISSIONS**

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 15.8  | 34.7  | 158   | 347   | 0.17       |
| ROC (as CH4)             | 0.932       | 0.9   | 2.1   | 9     | 21    | 0.01       |
| Carbon Monoxide (CO)     | 2.864       | 2.9   | 6.3   | 29    | 63    | 0.03       |

|                        |         |       |         |       |        |      |
|------------------------|---------|-------|---------|-------|--------|------|
| Sulfur Dioxide (SO2)   | 0.199   | 0.2   | 0.4     | 2     | 4      | 0.00 |
| Particulates (as PM10) | 0.941   | 0.9   | 2.1     | 9     | 21     | 0.01 |
| Carbon Dioxide (CO2)   | 631.089 | 631.1 | 1,391.3 | 6,311 | 13,913 | 6.96 |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### GENERATOR/AUXILIARY EMISSIONS

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 1.6   | 3.5   | 16    | 35    | 0.02       |
| ROC (as CH4)             | 0.932       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Monoxide (CO)     | 2.864       | 0.3   | 0.6   | 3     | 6     | 0.00       |
| Sulfur Dioxide (SO2)     | 0.199       | 0.0   | 0.0   | 0     | 0     | 0.00       |
| Particulates (as PM10)   | 0.941       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Dioxide (CO2)     | 631.089     | 63.1  | 139.1 | 631   | 1,391 | 0.70       |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### COMBINED EMISSIONS - GRAND TOTAL

| Pollutant                |  |  |  | Total | Total  | Grand Total |
|--------------------------|--|--|--|-------|--------|-------------|
| Type                     |  |  |  | kg    | lb     | short tons  |
| Nitrogen Oxides (as NO2) |  |  |  | 173   | 382    | 0.19        |
| ROC (as CH4)             |  |  |  | 10    | 23     | 0.01        |
| Carbon Monoxide (CO)     |  |  |  | 32    | 69     | 0.03        |
| Sulfur Dioxide (SO2)     |  |  |  | 2     | 5      | 0.00        |
| Particulates (as PM10)   |  |  |  | 10    | 23     | 0.01        |
| Carbon Dioxide (CO2)     |  |  |  | 6,942 | 15,304 | 7.65        |

**WSPA Marine  
Vessel  
Emission  
Estimation  
Form  
Low Sulfur  
Diesel Fuel -  
0.05% Sulfur**

Location/Port:

Vessel Name:

Submission Date:

| Main Engines        |                                   |       |
|---------------------|-----------------------------------|-------|
|                     |                                   | Units |
| Total Engine Rating | 1000                              | BHP   |
| Fuel Type           | Low Sulfur Diesel<br>0.05% Sulfur |       |
| Hours Operation     | 10                                | Hours |
| Load                | 100                               | %     |

| Generator/Auxiliary |                                      |       |
|---------------------|--------------------------------------|-------|
|                     |                                      | Units |
| Total Engine Rating | 100                                  | BHP   |
| Fuel Type           | Low Sulfur<br>Diesel 0.05%<br>Sulfur |       |
| Hours Operation     | 10                                   | Hours |
| Load                | 100                                  | %     |

**MAIN ENGINES  
EMISSIONS**

| Pollutant                             | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|---------------------------------------|-------------|-------|-------|-------|-------|------------|
| Type                                  | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO <sub>2</sub> ) | 15.754      | 15.8  | 34.7  | 158   | 347   | 0.17       |
| ROC (as CH <sub>4</sub> )             | 0.932       | 0.9   | 2.1   | 9     | 21    | 0.01       |
| Carbon Monoxide (CO)                  | 2.864       | 2.9   | 6.3   | 29    | 63    | 0.03       |

|                        |         |       |         |       |        |      |
|------------------------|---------|-------|---------|-------|--------|------|
| Sulfur Dioxide (SO2)   | 0.199   | 0.2   | 0.4     | 2     | 4      | 0.00 |
| Particulates (as PM10) | 0.941   | 0.9   | 2.1     | 9     | 21     | 0.01 |
| Carbon Dioxide (CO2)   | 631.089 | 631.1 | 1,391.3 | 6,311 | 13,913 | 6.96 |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### GENERATOR/AUXILIARY EMISSIONS

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 1.6   | 3.5   | 16    | 35    | 0.02       |
| ROC (as CH4)             | 0.932       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Monoxide (CO)     | 2.864       | 0.3   | 0.6   | 3     | 6     | 0.00       |
| Sulfur Dioxide (SO2)     | 0.199       | 0.0   | 0.0   | 0     | 0     | 0.00       |
| Particulates (as PM10)   | 0.941       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Dioxide (CO2)     | 631.089     | 63.1  | 139.1 | 631   | 1,391 | 0.70       |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### COMBINED EMISSIONS - GRAND TOTAL

| Pollutant                |  |  |  | Total | Total  | Grand Total |
|--------------------------|--|--|--|-------|--------|-------------|
| Type                     |  |  |  | kg    | lb     | short tons  |
| Nitrogen Oxides (as NO2) |  |  |  | 173   | 382    | 0.19        |
| ROC (as CH4)             |  |  |  | 10    | 23     | 0.01        |
| Carbon Monoxide (CO)     |  |  |  | 32    | 69     | 0.03        |
| Sulfur Dioxide (SO2)     |  |  |  | 2     | 5      | 0.00        |
| Particulates (as PM10)   |  |  |  | 10    | 23     | 0.01        |
| Carbon Dioxide (CO2)     |  |  |  | 6,942 | 15,304 | 7.65        |



**WSPA Marine  
Vessel  
Emission  
Estimation  
Form  
Low Sulfur  
Diesel Fuel -  
0.05% Sulfur**

Location/Port:

Vessel Name:

Submission Date:

| Main Engines        |                                   |       |
|---------------------|-----------------------------------|-------|
|                     |                                   | Units |
| Total Engine Rating | 1000                              | BHP   |
| Fuel Type           | Low Sulfur Diesel<br>0.05% Sulfur |       |
| Hours Operation     | 10                                | Hours |
| Load                | 100                               | %     |

| Generator/Auxiliary |                                      |       |
|---------------------|--------------------------------------|-------|
|                     |                                      | Units |
| Total Engine Rating | 100                                  | BHP   |
| Fuel Type           | Low Sulfur<br>Diesel 0.05%<br>Sulfur |       |
| Hours Operation     | 10                                   | Hours |
| Load                | 100                                  | %     |

**MAIN ENGINES  
EMISSIONS**

| Pollutant                             | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|---------------------------------------|-------------|-------|-------|-------|-------|------------|
| Type                                  | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO <sub>2</sub> ) | 15.754      | 15.8  | 34.7  | 158   | 347   | 0.17       |
| ROC (as CH <sub>4</sub> )             | 0.932       | 0.9   | 2.1   | 9     | 21    | 0.01       |
| Carbon Monoxide (CO)                  | 2.864       | 2.9   | 6.3   | 29    | 63    | 0.03       |

|                        |         |       |         |       |        |      |
|------------------------|---------|-------|---------|-------|--------|------|
| Sulfur Dioxide (SO2)   | 0.199   | 0.2   | 0.4     | 2     | 4      | 0.00 |
| Particulates (as PM10) | 0.941   | 0.9   | 2.1     | 9     | 21     | 0.01 |
| Carbon Dioxide (CO2)   | 631.089 | 631.1 | 1,391.3 | 6,311 | 13,913 | 6.96 |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### GENERATOR/AUXILIARY EMISSIONS

| Pollutant                | Em. Factor* | Rate  | Rate  | Total | Total | Total      |
|--------------------------|-------------|-------|-------|-------|-------|------------|
| Type                     | g/bhp-hr    | kg/hr | lb/hr | kg    | lb    | short tons |
| Nitrogen Oxides (as NO2) | 15.754      | 1.6   | 3.5   | 16    | 35    | 0.02       |
| ROC (as CH4)             | 0.932       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Monoxide (CO)     | 2.864       | 0.3   | 0.6   | 3     | 6     | 0.00       |
| Sulfur Dioxide (SO2)     | 0.199       | 0.0   | 0.0   | 0     | 0     | 0.00       |
| Particulates (as PM10)   | 0.941       | 0.1   | 0.2   | 1     | 2     | 0.00       |
| Carbon Dioxide (CO2)     | 631.089     | 63.1  | 139.1 | 631   | 1,391 | 0.70       |

*\*Based on 30%  
energy  
conversion  
efficiency*

#### COMBINED EMISSIONS - GRAND TOTAL

| Pollutant                |  |  |  | Total | Total  | Grand Total |
|--------------------------|--|--|--|-------|--------|-------------|
| Type                     |  |  |  | kg    | lb     | short tons  |
| Nitrogen Oxides (as NO2) |  |  |  | 173   | 382    | 0.19        |
| ROC (as CH4)             |  |  |  | 10    | 23     | 0.01        |
| Carbon Monoxide (CO)     |  |  |  | 32    | 69     | 0.03        |
| Sulfur Dioxide (SO2)     |  |  |  | 2     | 5      | 0.00        |
| Particulates (as PM10)   |  |  |  | 10    | 23     | 0.01        |
| Carbon Dioxide (CO2)     |  |  |  | 6,942 | 15,304 | 7.65        |

